Packet Classification Based on Layer 3 Packet Length

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This feature provides the added capability of matching and classifying traffic on the basis of the Layer 3 packet length in the IP header. The Layer 3 packet length is the IP datagram length plus the IP header length. This new match criterion is in addition to other match criteria, such as the IP precedence, the differentiated services code point (DSCP) value, and the class of service (CoS).

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the "Feature Information for Packet Classification Based on Layer 3 Packet Length" section on page 11.

Use Cisco Feature Navigator to find information about platform support and Cisco IOS, Catalyst OS, and Cisco IOS software image support. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn. An account on Cisco.com is not required.

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Prerequisites for Packet Classification Based on Layer 3 Packet Length

When configuring this feature, you must first create a policy map (sometimes referred to as a service policy or a traffic policy) using the Modular QoS Command-Line Interface (CLI) (MQC). Therefore, you should be familiar with the procedure for creating a policy map using the MQC.

For more information about creating a policy map (traffic policy) using the MQC, see the "Applying QoS Features Using the MQC" module.

Restrictions for Packet Classification Based on Layer 3 Packet Length

- This feature is intended for use with IP packets only.
- This feature considers only the Layer 3 packet length in the IP header. It does not consider the Layer 2 overhead.

Information About Packet Classification Based on Layer 3 Packet Length

- MQC and Packet Classification Based on Layer 3 Packet Length, page 2

MQC and Packet Classification Based on Layer 3 Packet Length

Use the MQC to enable packet classification based on Layer 3 packet length. The MQC is a CLI that allows you to create traffic policies, enable a QoS feature (such as packet classification), and attach these policies to interfaces.

In the MQC, the **class-map** command is used to define a traffic class (which is then associated with a traffic policy). The purpose of a traffic class is to classify traffic.

The MQC consists of the following three processes:

- Defining a traffic class with the **class-map** command.
- Creating a traffic policy by associating the traffic class with one or more QoS features (using the **policy-map** command).
- Attaching the traffic policy to the interface with the **service-policy** command.

A traffic class contains three major elements: a name, a series of **match** commands, and, if more than one **match** command exists in the traffic class, an instruction on how to evaluate these **match** commands. The traffic class is named in the **class-map** command line; for example, if you enter the **class-map cisco** command while configuring the traffic class in the CLI, the traffic class would be named "cisco".

The **match** commands are used to specify various criteria for classifying packets. Packets are checked to determine whether they match the criteria specified in the **match** commands. If a packet matches the specified criteria, that packet is considered a member of the class and is forwarded according to the QoS specifications set in the traffic policy. Packets that fail to meet any of the matching criteria are classified as members of the default traffic class.

How to Configure Packet Classification Based on Layer 3 Packet Length

This section contains the following procedures. Each procedure is identified as either required or optional.

- Configuring the Class Map to Match on Layer 3 Packet Length, page 3 (required)
- Attaching the Policy Map to an Interface, page 4 (required)
- Verifying the Layer 3 Packet Length Classification Configuration, page 6 (optional)

Configuring the Class Map to Match on Layer 3 Packet Length

Class maps can be used to classify packets into groups that can then receive specific QoS features. For example, class maps can be configured to match packets on the basis of one or more user-specified criteria (for example, the DSCP value or access list number). In this procedure, the class map is configured to match on the Layer 3 packet length.

To configure the class map to match on the Layer 3 packet length, complete the following steps.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **class-map** *class-map-name*
4. **match packet length** {**max** *maximum-length-value* [**min** *minimum-length-value*] | **min** *minimum-length-value* [**max** *maximum-length-value*]}
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** Router# configure terminal	Enters global configuration mode.
Step 3	**class-map** *class-map-name* **Example:** Router(config)# class-map class1	Specifies the name of the class map to be created and enters class-map configuration mode. • Enter the class map name.
Step 4	**match packet length** {**max** *maximum-length-value* [**min** *minimum-length-value*] | **min** *minimum-length-value* [**max** *maximum-length-value*]} **Example:** Router(config-cmap)# match packet length min 100 max 300	Configures the class map to match traffic on the basis of the Layer 3 packet length. • Enter the Layer 3 packet length in bytes.
Step 5	**end** **Example:** Router(config-cmap)# end	(Optional) Exits class-map configuration mode and returns to privileged EXEC mode.

Attaching the Policy Map to an Interface

After a policy map is created, the next step is to attach the policy map to an interface. Policy maps can be attached to either the input direction or the output direction of the interface.

Note Depending on the needs of your network, you may need to attach the policy map to a subinterface, an ATM permanent virtual circuit (PVC), a Frame Relay data-link connection identifier (DLCI), or other type of interface.

To attach the policy map, complete the following steps.

Prerequisite

Before attaching the policy map to an interface, the policy map must be created using the MQC. To create a policy map using the MQC, see the "Applying QoS Features Using the MQC" module.

SUMMARY STEPS

1. **enable**

2. **configure terminal**

3. **interface** *type number*

4. **pvc** [*name*] *vpi*/*vci* [**ilmi** | **qsaal** | **smds**]

5. **service-policy** {**input** | **output**} *policy-map-name*

6. **end**

DETAILED STEPS

	Command or Action	Purpose

Step 1	`enable`
	
	Example:
	`Router> enable`
		Enables privileged EXEC mode.
		
		• Enter your password if prompted.

Step 2	`configure terminal`
	
	Example:
	`Router# configure terminal`
		Enters global configuration mode.

Step 3	`interface` *type number* **Example:** `Router(config)# interface serial4/0`	Configures an interface (or subinterface) type and enters interface configuration mode • Enter the interface type and number.
Step 4	`pvc` [*name*] *vpi***/***vci* [`ilmi` | `qsaal` | `smds`] **Example:** `Router(config-if)# pvc cisco 0/16 ilmi`	(Optional) Creates or assigns a name to an ATM PVC, specifies the encapsulation type on an ATM PVC, and enters ATM VC configuration mode. **Note** This step is required only if you are attaching the policy map to an ATM PVC. If you are not attaching the policy map to an ATM PVC, skip this step and proceed with Step 5.

	Command or Action	Purpose
Step 5	**service-policy** {**input**	**output**} *policy-map-name* **Example:** Router(config-if)# service-policy input policy1 or **Example:** Router(config-if-atm-vc)# service-policy input policy1	Specifies the name of the policy map to be attached to either the *input or output* direction of the interface. **Note** Policy maps can be configured on ingress or egress routers. They can also be attached in the input or output direction of an interface. The direction (input or output) and the router (ingress or egress) to which the policy map should be attached varies according your network configuration. When using the **service-policy** command to attach the policy map to an interface, be sure to choose the router and the interface direction that are appropriate for your network configuration. • Enter the policy map name.
Step 6	**end** **Example:** Router(config-if)# end or **Example:** Router(config-if-atm-vc)# end	(Optional) Exits interface configuration mode and returns to privileged EXEC mode.

Verifying the Layer 3 Packet Length Classification Configuration

This task allows you to verify that you created the configuration that you intended and that the feature is functioning correctly.

To verify the configuration, use one or more of the **show** commands listed in the following steps.

SUMMARY STEPS

1. **enable**
2. **show class-map** [*class-map-name*]
3. **show policy-map interface** *interface-name* [**vc** [*vpi/*] *vci*] [**dlci** *dlci*] [**input** | **output**]
4. **exit**

DETAILED STEPS

	Command or Action	Purpose

Step 1	`enable`
	
	Example:
	`Router> enable`
		Enables privileged EXEC mode.
		
		• Enter your password if prompted.

Step 2	`show class-map` [*class-map-name*] **Example:** `Router# show class-map class1`	(Optional) Displays all information about a class map, including the match criterion. • Enter the class map name.
Step 3	`show policy-map interface` *interface-name* [`vc` [*vpi/*] *vci*] [`dlci` *dlci*] [`input` | `output`] **Example:** `Router# show policy-map interface serial4/0`	(Optional) Displays the packet statistics of all classes that are configured for all service policies either on the specified interface or subinterface or on a specific PVC on the interface. • Enter the interface name.

Step 4	`exit`
	
	Example:
	`Router# exit`
		(Optional) Exits privileged EXEC mode.

Troubleshooting Tips

The commands in the "Verifying the Layer 3 Packet Length Classification Configuration" section allow you to verify that you achieved the intended configuration and that the feature is functioning correctly. If, after using the **show** commands listed above, you find that the configuration is not correct or that the feature is not functioning as expected, perform these operations:

If the configuration is not the one that you intended, perform the following operations:

- Use the **show running-config** command and analyze the output of the command.
- If the policy map does not appear in the output of the **show running-config** command, enable the **logging console** command.
- Attach the policy map to the interface again.

If the packets are not being matched correctly (for example, the packet counters are not incrementing correctly), performs the following operations:

- Run the **show policy-map** command and analyze the output of the command.
- Run the **show running-config** command and analyze the output of the command.
- Use the **show policy-map interface** command and analyze the output of the command. Check the the following:
    - If a policy map applies queueing, and the packets are matching the correct class, but you see unexpected results, compare the number of packets in the queue with the number of packets matched.
    - If the interface is congested, and only a small number of packets are being matched, check the tuning of the tx ring and evaluate whether queueing is happening on the tx ring. To do this, use the **show controllers** command and look at the value of the tx count in the output.

Configuration Examples for Packet Classification Based on Layer 3 Packet Length

Example: Configuring the Layer 3 Packet Length As a Match Criterion

In the following example, a class map called "class 1" has been created, and the Layer 3 packet length has been specified as a match criterion. In this example, packets with a minimum Layer 3 packet length of 100 bytes and a maximum Layer 3 packet length of 300 bytes are viewed as meeting the match criterion. Packets matching this criterion are placed in class1.

```
Router(config)# class map class1
Router(config-cmap)# match packet length min 100 max 300
```

Example: Verifying the Layer 3 Packet Length Setting

Use either the **show class-map** command or the **show policy-map interface** command to verify the setting of the Layer 3 packet length value used as a match criterion for the class map and the policy map. The following section begins with sample output of the **show class-map** command and concludes with sample output of the **show policy-map interface** command.

The sample output of the **show class-map** command shows the defined class map and the specified match criterion. In the following example, a class map called "class1" is defined. The Layer 3 packet length has been specified as a match criterion for the class. Packets with a Layer 3 length of between 100 bytes and 300 bytes belong to class1.

```
Router# show class-map

class-map match-all class1
    match packet length min 100 max 300
```

The sample output of the **show policy-map interface** command displays the statistics for Ethernet interface 4/1, to which a service policy called "mypolicy" is attached. The configuration for the policy map called "mypolicy" is given below.

```
Router(config)# policy-map mypolicy
Router(config-pmap)# class class1
Router(config-pmap-c)# set qos-group 20
Router(config-pmap-c)# exit
Router(config-pmap)# exit
Router(config)# exit
Router(config)# interface ethernet4/1
Router(config-if)# service-policy input mypolicy
```

The following are the statistics for the policy map called "mypolicy" attached to Ethernet interface 4/1. These statistics confirm that matching on the Layer 3 packet length has been configured as a match criterion.

```
Router# show policy-map interface Ethernet4/1

 Ethernet4/1
```

```
Service-policy input: mypolicy

  Class-map: class1 (match-all)
      500 packets, 125000 bytes
      5 minute offered rate 4000 bps, drop rate 0 bps
      Match: packet length min 100 max 300
      QoS Set
        qos-group 20
          Packets marked 500
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	*Cisco IOS Master Commands List, All Releases*
QoS commands: complete command syntax, command modes, command history, defaults, usage guidelines, and examples	*Cisco IOS Quality of Service Solutions Command Reference*
MQC	"Applying QoS Features Using the MQC" module
Additional match criteria that can be used for packet classification	"Classifying Network Traffic" module
Information about attaching policy maps to interfaces	"Applying QoS Features Using the MQC" module
Classifying network traffic	"Classifying Network Traffic" module
Marking network traffic	"Marking Network Traffic" module

Standards

Standard	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	—

MIBs

MIB	MIBs Link
• CISCO-CLASS-BASED-QOS-CAPABILITY-MIB • CISCO-CLASS-BASED-QOS-MIB	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	—

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Packet Classification Based on Layer 3 Packet Length

Table 1 lists the release history for this feature.

Use Cisco Feature Navigator to find information about platform support and software image support. Cisco Feature Navigator enables you to determine which software images support a specific software release, feature set, or platform. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn. An account on Cisco.com is not required.

Note   Table 1 lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Table 1   Feature Information for Packet Classification Based on Layer 3 Packet Length

Feature Name	Releases	Feature Information
Packet Classification Based on Layer 3 Packet Length	12.2(13)T 12.2(18)SXE	This feature provides the added capability of matching and classifying traffic on the basis of the Layer 3 packet length in the IP header. In Release 12.2(13)T, this feature was introduced. In Release 12.2(18)SXE, this feature was integrated into Cisco IOS Release 12.2(18)SXE. The following commands were introduced or modified: **match packet length** (class-map), **show class-map**, **show policy-map interface**.